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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: HOFMEISTER

SERIAL NO.: 09/163,844 ART UNIT: 3652

FILED: 9/30/98 EXAMINER: Underwood, D.

TITLE: SUBSTRATE TRANSPORT APPARATUS

ATTORNEY DOCKET NO.: 390-008105-US (PAR)

Commissioner of Patents
Washington, D.C. 20231

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BRIEF FOR APPELLANTS

Sir:

This is an appeal brief in regard to the final rejection of the claims in the above-identified patent application. A Notice of Appeal was mailed to the PTO on September 5, 2001. This brief is being filed in triplicate as required by 37 C.F.R. §1.192. The fee under 37 C.F.R. §1.17(f) is enclosed. Also enclosed is a fee of $110.00 as payment for the fee for a petition for a one-month extension of time. Please charge deposit account 16-1350 for any fee deficiency.

I. Real Party In Interest

The real party in interest is Brooks Automation, Inc, a Delaware Corporation with offices at 15 Elisabeth Drive, Chelmsford, MA.

II. Related Appeals and Interferences

There are no directly related appeals or interferences regarding this application.

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III. Status of Claims

Claims 1-29 are pending in this Application. Claims 1-5, 8-16, 26, and 28-29 have been finally rejected by the Examiner. Claims 6-7, and 19-23 have been allowed. Claims 17-18, 24-25, and 27 have been objected to. The rejection of Claims 1-5, 8-16, 26, and 28-29 is appealed.

IV. Status of Amendments

No amendments have been filed after the final rejection.

V. Summary of the Invention

The present invention as described on page 9, lines 25-33, ad page 10, lines 10-16, relates to a substrate transport apparatus having a drive section 27 with two drive shafts, and a three link arm assembly 25. The arm assembly has a wrist extension 34 which is rotatably mounted to the wrist 42. The rotation of the wrist extension 34 about the wrist is slaved to the rotation of the forearm 31 about the elbow of the arm assembly. As can be seen in Figs. 2A, 3A, and 5, the two drive shaft drive section 27 drives the arm assembly 25 to pick and release substrates from adjacent side by side substrate holding areas 26L, 26R with the drive section remaining in one place between the holding areas.

VI. Issues

1. Is Claim 5 unpatentable under 35 U.S.C. 102(b) as being anticipated by Fukasawa et al. (hereinafter Fukasawa).

2. Are Claims 1-4, 26, and 29 unpatentable under 35 U.S.C. 103(a) as being obvious over Fukasawa.

3. Are Claims 1-4, 26, and 29 unpatentable under 35 U.S.C. 103(a) as being obvious over Fukasawa in view of Bacchi et al. (hereinafter Bacchi).

4. Are Claims 1-4, 26, and 29 unpatentable under 35 U.S.C. 103(a) as being obvious over Fukasawa in view of Sawada.

5. Are Claims 8-16, and 28 unpatentable under 35 U.S.C. 103(a) as being obvious over Bacchi in view of Ohta et al. (hereinafter Ohta).

6. Are Claims 8-16, and 28 unpatentable under 35 U.S.C. 103(a) as being obvious over Ohta in view of Bacchi.

VII. Grouping Of Claims

The claims do not stand or fall together. There are six groups of claims as follows:

Group 1 - Claim 5
Group 2 - Claims 1-4
Group 3 - Claim 26
Group 4 - Claim 29
Group 5 - Claims 8-16
Group 6 - Claim 28

In accordance with 37 C.F.R. §1.192(c)(7), an explanation of why the claims of the groups are believed to be separately patentable is contained in the Argument section below.

VIII. Argument

1. Claim 5

Claim 5 calls for the initial and final position of the end effector being connected by an axis of translation which is one of two generally parallel axes of translation of the end effector; wherein

> -radial displacement of the end effector complements rotation of the transport arm as a unit to result in the substrate being translated along the axis of translation.

Fukasawa does not anticipate the combination of features called for in claim 5. Fukasawa discloses a multi-joint arm member 5 with three convey arms (lower 51, middle 52, upper 53) which are independently pivoted (col. 6, lines 40-43). As shown in Fig. 4, each arm 51, 52, 53 of the multi-joint arm 5 in Fukasawa is pivoted by an independent motor (col. 6, lines 49-51). Fukasawa makes no mention whatsoever of the path followed by the upper convey arm 53, and substrate into and out of the substrate holding areas (cassette chambers 3a, 3b or processing chambers 4a, 4b). Nowhere does Fukasawa disclose or suggest that the end effector is moved from an initial position to a final position along an axis of translation, or that the substrate is moved into and out of the substrate holding area along the axis of translation connecting

the initial and final positions of the end effector as otherwise called for in claim 5.

The Examiner states (in the Office Action of 12/19/00) that rectilinear translation of the wafers into the cassettes of Fukasawa is inherent or else the wafers would not enter between the parallel sides of the cassettes. The Examiner is incorrect. In Fukasawa, it is not necessary that the wafers be rectilinearly translated into or out of the cassettes 3a, 3b or processing chambers 4a, 4b. For example, the wafers are shown in Fukasawa as being round. During insertion of the wafer, the clearance between the walls of the cassette and round perimeter of the wafer varies according to the round geometry of the wafer (i.e. $d = D/2 - R \sin \ominus$, and $\cos \ominus = R-x/R$ where d is the clearance between the cassette walls, R is the radius of the wafer, and x is the distance the wafer extends into the cassette). Thus, up to the point where the maximum diameter of the wafer is inside the cassette, the wafer may be moved into the cassette along a curvilinear path. Conversely, the wafer may be removed from the cassette, at least in part, along a curvilinear path. Outside the cassette, the wafer can be moved along any number of paths as can be provided with the three independently pivotable convey arms (51, 52, 53) in Fukasawa which has a high degree of freedom. In col. 10, lines 41-43, Fukasawa discloses that the convey path for a wafer can be freely selected. Hence, outside the cassette, it is clearly not necessary that the wafer in Fukasawa be transported along a rectilinear path. Therefore, in Fukasawa, it is not inherent that the wafer be rectilinearly translated into the or out of the cassette.

Furthermore, claim 5 does not call merely for the substrate to be rectilinearly translated into/out of the holding area. Rather, claim 5 calls for the initial and final position of the end effector being connected by an axis of translation which is:

one of two generally parallel axes of translation; wherein

radial displacement of the end effector complements rotation of the transport arm as a unit to result in the substrate being translated along the axis of translation.

Nowhere does Fukasawa make any mention that the radial displacement of the end effector (convey arm 53) relative to the axis of rotation of the transport arm has any particular relation to (i.e. complement) the rotation of the transport arm as a unit about the axis of rotation. On the contrary, in Col. 10, lines 41-43, Fukasawa discloses that the movements of each convey arm 51-53 can be freely selected within the stroke range of each arm 51-53. Thus, arguably, even if the wafer W in Fukasawa is transported along an axis of translation (though the Applicant maintains that Fukasawa does not disclose this), this is not necessarily the result of the end effector (arm 53) being radially displaced relative to shaft 61 (the axis of rotation of the multi-joint arm 5 as a unit) to complement the rotation of the multi-joint arm 5 as a unit. For example, wafer W may be moved along an axis by independently pivoting convey arms 53, 52 respectively about shafts 53a (the wrist), and 52a (the elbow). In this case, the multi-joint arm 5 itself need not be rotated as a unit about

shaft 61a (as is otherwise called for in claim 5). Thus, Fukasawa simply does not disclose that the radial displacement of the end effector complements rotation of the transport arm as a unit to result in the substrate being translated along the axis of translation connecting the initial and final position of the end effector as is called for in claim 5.

Fukasawa does not disclose the features of claim 5. Moreover, the Examiner fails to cite any other reference or relevant rule of law which renders claim 5 unpatentable. The Examiner's rejection should be reversed.

2. Claims 1-4

a. Claim 1 is not obvious over Fukasawa

Claim 1 calls for rotating the two drive shafts to:

effect rotation of the transport arm (which rotates the wrist about the shoulder) and to;

effect extension of the transport arm (which radially displaces the wrist relative to the shoulders;

wherein radial displacement of the wrist causes rotation of the end effector about the wrist to;

rotate the substrate (on the end effector) about the shoulder in concert with rotation of the wrist about the shoulder, so that the

substrate is moved along one of a number of parallel axes straddling the drive section.

Fukasawa does not disclose or suggest the features recited in claim 1. As noted before Fukasawa discloses a multi-joint arm 5 with three independently pivoted convey arms 51, 52, 53 (col. 6, lines 40-43). Each arm 51, 52, 53 of the multi-joint arm 5 in Fukasawa is pivoted by an independent motor (e.g. lower arm 51 is pivoted by a first motor which rotates shaft 61, middle arm 52 is pivoted by a second motor which rotates shaft 52a, upper arm 53 is pivoted by a third motor which rotates shaft 53a). In Fukasawa, rotation of the multi-joint arm 5 is accomplished by pivoting lower arm 51 by rotating shaft 61. Extension of the multi-joint arm 5 to radially displace the wrist (i.e. shaft 53a) from the shoulder (i.e. shaft 61) is accomplished by pivoting the middle arm 52 by rotating shaft 52a. Thus, in Fukasawa, all three shafts 61, 52a, and 53a must be rotated to rotate the transport arm about the shoulder, extend the transport arm to radially displace the wrist, and rotate the upper convey arm about the wrist.

The multi-joint arm 5 in Fukasawa cannot be rotated (to rotate the wrist about the shoulder), cannot be extended (to radially displace the wrist from the shoulder), and the end effector cannot be rotated about the wrist, only by rotating two drive shafts regardless of the number of arms the Examiner assumes. The Examiner's assumption of only two arms is wrong. The multi-joint arm in Fukasawa cannot and does not perform the features called for in claim 1 with only two arms, and more to the point by rotating only two drive shafts. For example, if the lower arm 51 and the upper arm are rotated (i.e. by respectively rotating

shafts 61 and 53a) then the arm 5 is not extended (i.e. the wrist is not displaced relative to the shoulder) as called for in claim 1. If it is the middle arm 52 and the upper arm 53 that are rotated (i.e. by rotating shafts 52a, and 53a), then the arm 5 itself is not rotated to rotate the wrist about the shoulder as called for in claim 1. If only the lower arm 51 and middle arm 52 are rotated (by rotating shafts 61 and 52a), then in Fukasawa the upper arm 53 is not rotated about the wrist as called for in claim 1. There is simply no disclosure or suggestion in Fukasawa of rotating two drive shafts to effect rotation of the transport arm (i.e. unit body rotation), to effect extension of the arm (displacing the wrist from the shoulder) and to cause rotation of the end effector about the wrist as otherwise called for in claim 1.

Moreover, nowhere does Fukasawa disclose or suggest that the rotation of the end effector (upper convey arm 53) about the wrist is such as to rotate a substrate (on convey arm 53) about the shoulder in concert with rotation of the wrist about the shoulder so that the substrate is moved along as otherwise called for in claim 1. In other words, in claim 1 the rotation of the substrate about the shoulder in concert with the rotation of the wrist about the shoulder moves the substrate along the translation axis.

Thus, according to the features recited in claim 1, the substrate is moved along one of a number of parallel axes straddling the drive section by:

1. rotating the transport arm which rotates the wrist about the shoulder;

2. rotating the substrate about the shoulder by extending the arm; and

3. the rotation of the wrist and the rotation of the substrate being in concert such that the substrate travels along a straight line.

Nothing like this is disclosed or suggested in Fukasawa. As noted before, Fukasawa discloses merely that the independently movable convey arms 51-53 allow the convey path of a wafer to be freely selected. Fukasawa however makes no mention as to how the convey arms 51-53 are moved to convey wafer W along any path, or along a straight path such as when the wafer is inside the cassette. For instance, in Fukasawa the wafer may be conveyed along a straight line inside the cassette without rotating the multi-joint arm 5 about the shoulder (shaft 61a). Fukasawa does not disclose or suggest the features called for in Claim 1. The Examiner's rejection of Claim 1 based on Fukasawa should be reversed.

b. Claim 1 is not obvious over Fukasawa in view of Bacchi

As noted before, Fukasawa fails to disclose or suggest rotating two drive shafts to effect rotation of the transport arm and to effect extension of the transport arm, wherein radial displacement of the wrist causes rotation of the end effector about the wrist to rotate the substrate about the shoulder in concert with rotation of the wrist about the shoulder so that the substrate is moved along one of a number of parallel axes straddling the drive section, as called for in Claim 1.

Bacchi discloses a three-link robot arm mechanism 10 which is positioned by first and second concentric motors (col. 4, lines 36-44). The first motor 50 rotates the forearm 22 and the second motor rotates the upper arm 14. The hand 30 is connected to the forearm by a passive drive link 90 which fixes the orientation of the hand 30 so that as the forearm rotates the hand remains aligned along an axis extending through the center of the concentric motors. Thus, the three-link robot arm in Bacchi has two degrees of freedom. In the Office Action mailed on 6/20/01, the Examiner states that it would have been an obvious substitution of equivalents to substitute the arm 10 in Bacchi with two drive shafts for the arm in Fukasawa. The Examiner is incorrect. In Fukasawa, each convey arm (upper arm 51, middle arm 52, lower arm 53) is independently pivoted by an independent motor. This provides the arm assembly 5 in Fukasawa with three independent degrees of freedom. The arm mechanism 10 in Bacchi with two independent degrees of freedom is not equivalent to the arm assembly 5 in Fukasawa with three independent degrees of freedom. In addition, Bacchi discloses that the positions to which the arm mechanism 10 can move wafers is different than in Fukasawa. In Fukasawa chambers 3a, 3b are offset on both sides of the drive section, but in Bacchi one cassette 168L is in line with the center of the drive section. Thus, a person skilled in the art, would not recognize the arm mechanism 10 in Bacchi to be equivalent to the arm assembly 5 in Fukasawa, and thus would not substitute the Bacchi arm for that in Fukasawa.

Furthermore, as seen in Fig. 6a, Bacchi discloses that arm mechanism 10 removes wafers from two cassettes 168l, 168r along corresponding straight line transport paths. The transport paths corresponding to cassettes 168l, 168r appear to be parallel but

are not straddling the drive section of the arm as otherwise called for in claim 1. In Bacchi, the drive section (i.e. drive motors 50, 52) is located at the shoulder 16 of the arm mechanism (see Fig. 2). As disclosed in Fig. 6a, the straight line transport path to cassette 168l in Bacchi extends through the shoulder. Hence, the transport paths in Bacchi do not straddle the drive section of the arm. Nowhere does Bacchi disclose or suggest that arm 10 moves the wafer into and out of the cassettes along one of a number of parallel axes straddling the drive section as called for in claim 1.

The applicant submits that due to the differences between Fukasawa and Bacchi in both the arm mechanism (i.e. Fukasawa having a three degree of freedom arm; Bacchi having a two degree of freedom arm) and the location of the storage areas (i.e. Fukasawa having all chambers 3a, 3b offset from the drive section; Bacchi has one cassette 168l in line with the drive section) it would not have been obvious for one skilled in the art to combine Fukasawa and Bacchi. Nevertheless, even if Fukasawa and Bacchi were combined (although the appellant maintains that it would not be obvious for one skilled in the art to do so) claim 1 remains patentable. As noted before, Fukasawa discloses an arm with three degrees of freedom transporting wafers to chambers 3a, 3b, 4a, 4b which are offset on both sides of the arm drive section, but fails to make any mention whatsoever of the transport paths along which the wafers are moved. Bacchi on the other hand discloses a two-degree of freedom arm, which moves wafers along two straight line transport paths, to cassettes 168l, 168r, one of which extends through the centerline of the arm drive section. Thus, nothing in Fukasawa and Bacchi make it obvious to one skilled in the art to rotate the drive shafts to rotate and extend the arm such that the

substrate is moved (into and out of the substrate holding areas) along one of a number of parallel axes straddling the drive section as otherwise called for in claim 1.

Claim 1 is not obvious over Fukasawa in view of Bacchi. The Examiner's rejection of claim 1 based on Fukasawa and Bacchi should be reversed.

C. Claim 1 is not obvious over Fukasawa in view of Sawada

Fukasawa fails to disclose or suggest rotating two drive shafts to effect rotation and extension of the transport arm, wherein radial displacement of the wrist causes rotation of the end effector about the wrist to rotate the substrate about the shoulder in concert with rotation of the wrist about the shoulder so that the substrate is moved along one of a number of parallel axes straddling the drive section, as called for in claim 1.

In Fig. 1, Sawada discloses a three link robot arm with a first arm driver 18 for driving the first arm 28, and a second arm driver 34 for driving the second arm 46. A passive drive assembly (50, 60, 62) links the rotation of the third arm 54 to the rotation of the second arm. Thus, Sawada discloses an arm assembly with two independent degrees of freedom similar to Bacchi. In addition, in Fig. 7A-7C, 9A-9C Sawada discloses only that the third arm 54 is moved along a single straight line h which extends through the shoulder O of the arm. Nowhere does Sawada disclose that the arm can move wafers to a location other than one which is in line with the shoulder of the arm. In contrast, the arm assembly in Fukasawa has three independent degrees of freedom and moves wafers to chambers 3a, 3b which are offset on both sides of the shoulder of the arm assembly. Hence,

a person skilled in the art would not recognize that the arm in Sawada is equivalent to the arm in Fukasawa and would not substitute the Sawada arm for that in Fukasawa as stated by the Examiner.

Sawada fails to disclose or suggest that the substrate is moved along one of a number of parallel axes, much less parallel axes straddling the drive section (of the transport arm) as otherwise called for in claim 1. Fukasawa also fails to disclose or suggest the features recited in claim 1. This, even if Fukasawa and Sawada were combined (though the appellant maintains that it would not have been obvious for one skilled in the art to do so), the combination of Fukasawa and Sawada does not provide the features called for in claim 1. Modifying the three independent degree of freedom arm in Fukasawa in view of the two independent degree of freedom arm in Sawada which can move substrates only along a centerline axis through the shoulder of the arm will not provide rotation of two drive shafts to rotate and extend the arm such that the substrate is moved into and out of substrate holding areas along one of a number of parallel axes straddling the drive section of the arm as otherwise called for in claim 1.

Claim 1 is not obvious over Fukasawa in view of Sawada. The Examiner's rejection of claim 1 based on Fukasawa and Sawada should be reversed.

3. Claim 26

a. Claim 26 is not obvious over Fukasawa

In addition to the features in claim 1, claim 26 recites that the substrate processing apparatus comprises three substrate holding

areas located side by side to each other, the transport arm transporting substrates into and out of each of the three holding areas with the shoulder of the arm staying in one location.

This is not disclosed or suggested in Fukasawa. In Fig. 2, Fukasawa merely discloses two side by side chambers (3a, 3b on one side and 4a, 4b of the other side). There is no disclosure or suggestion anywhere in Fukasawa of three substrate housing areas located side by side, with the transport arm transporting substrates to each with the shoulder staying in one location.

Claim 26 is not obvious over Fukasawa. The Examiner's rejection of claim 26 based on Fukasawa should be reversed.

b. Claim 26 is not obvious over Fukasawa in view of Bacchi

As noted before, Fukasawa fails to disclose or suggest the features in claim 26. In Fig. 6A, Bacchi discloses transporting substrates to two (not three) chambers 168l, 168r with the arm staying in place. Nowhere does Bacchi disclose or suggest three side by side chambers. Neither Fukasawa, nor Bacchi disclose the features recited in claim 26, and hence the combination of Fukasawa and Bacchi cannot provide features which are not disclosed or suggested in either reference.

Claim 26 is not obvious over Fukasawa in view of Bacchi. The Examiner's rejection of claim 26 based on Fukasawa and Bacchi should be reversed.

c. Claim 26 is not obvious over Fukasawa in view of Sawada

As noted before, Fukasawa fails to disclose or suggest the transport arm transporting substrates into and out of three side

by side holding areas with the shoulder of the arm staying in one location, as otherwise called for in claim 26. Sawada also fails to disclose or suggest this. As noted before, in Figs. 7A-7C; 9A-9C, Sawada only discloses transporting the substrate along one straight line path h. Sawada does not mention any holding areas. Hence, it appears that at most, Sawada discloses transporting the substrate (along one straight line path) to but one holding area, which is different from the features called for in claim 26. As neither Fukasawa, nor Sawada disclose or suggest the features called for in claim 26, the combination of Fukasawa and Sawada cannot provide features which are not disclosed or suggested in either reference.

Claim 26 is not obvious over Fukasawa in view of Sawada. The Examiner's rejection of claim 26 based on Fukasawa and Sawada should be reversed.

4. Claim 29

a. Claim 29 is not obvious over Fukasawa

Claim 29 calls for rotating two drive shafts to effect rotation of the arm, and extension of the arm which causes the end effector to rotate about the wrist, wherein rotation of the arm about the shoulder, and radial displacement of the wrist from the shoulder, and rotation of the end effector about the wrist are all in concert so that the substrate moves along one of a number of parallel axes straddling the shoulder.

Fukasawa does not disclose or suggest the features recited in claim 29. As noted before, Fukasawa discloses that multi-joint arm 5 has three independently pivoted convey arms 51, 52, 53

(col. 6, lines 40-43). Hence, in Fukasawa, three shafts (61, 52a, 53a (not two shafts) must be rotated to effect rotation of the arm, extension of the arm, and cause the end effector (convey arm 53) to rotate about the wrist. In addition, Fukasawa discloses merely that the independently movable convey arms 51-53 allow the convey path of a wafer to be freely selected. Fukasawa, makes no mention as to how the convey arms 51-53 are moved to convey wafer W along any path, much less a straight path, into and out of the cassettes. Thus, nowhere does Fukasawa disclose or suggest rotating two drive shafts to effect rotation of the arm, extension of the arm, and cause the end effector to rotate about the wrist, wherein rotation of the arm, and radial displacement of the wrist, and rotation of the end effector about the wrist are all in concert so the substrate moves along one of a number of parallel axes straddling the shoulder, as called for in claim 29.

Claim 29 is not obvious over Fukasawa. The Examiner's rejection of claim 29 based on Fukasawa should be reversed.

b. Claim 29 is not obvious over Fukasawa in view of Bacchi

Fukasawa fails to disclose rotating two drive shafts to effect rotation and extension of the arm, and cause rotation of the end effector about the wrist. Fukasawa fails to disclose that rotation and extension of the arm, and rotation of the end effector about thee wrist are in concert so that the substrate moves (into and out of the holding areas) along one of a number of parallel axes straddling the shoulder. With the three independently driven convey arms, 51, 52, 53, the rotation and extension of the arm and the rotation of convey arm 53 about the wrist in Fukasawa need not all be in concert in order to convey the wafer along any of the freely selected paths. Also, the

freely selected paths along which the Fukasawa arm, with three independently driven convey arms, can convey a wafer does not make it obvious to one skilled in the art to move the substrate along one of a number of parallel axes straddling the shoulder of the arm as otherwise called for in claim 29.

As noted before, Bacchi discloses an arm mechanism 10 with two independent degrees of freedom which is not equivalent to the arm in Fukasawa having three independent degrees of freedom. Also, the cassettes 168l, 168r to which the arm 10 in Bacchi moves the wafers are positioned differently (i.e., one cassette 168l is directly in front of the arm) than the position of the chambers (e.g. 3a, 3b) in Fukasawa. Thus the arm 10 in Bacchi is not equivalent to, and cannot be substituted for the arm in Fukasawa.

In addition, the transport paths to cassettes 168l, 168r in Bacchi do not straddle the shoulder of the arm. As seen in Fig. 6A, the path to cassette 168l extend directly through the shoulder (i.e. the origin in the X-Y axis plot) of the arm. Nowhere does Bacchi disclose or suggest that rotation of the arm, radial displacement of the wrist, and rotation of the end effector about the wrist, are all in concert so the substrate moves along one of a number of parallel axes straddling the shoulder as called for in claim 29. Neither Fukasawa, nor Bacchi disclose or suggest the features called for in claim 29. Thus, the combination of Fukasawa and Bacchi cannot provide features which are not disclosed or suggested in either reference.

Claim 19 is not obvious over Fukasawa in view of Bacchi. The Examiner's rejection of claim 29 based on Fukasawa in view of Bacchi should be reversed.

c. Claim 29 is not obvious over Fukasawa in view of Sawada.

Fukasawa fails to disclose rotating two drive shafts to effect rotation and extension of the arm, and cause rotation of the end effector about the wrist. Fukasawa fails to disclose that rotation and extension of the arm, and rotation of the end effector about the wrist are in concert so that the substrate moves (into and out of the holding areas) along one of a number of parallel axes straddling the shoulder. Sawada discloses an arm assembly with two independent degrees of freedom similar to Bacchi. In addition, Sawada discloses only that the third arm 54 is moved along a single straight line h which extends through the shoulder O of the arm (see Figs. 7A-7C, 9A-9C). Nowhere does Sawada disclose that the arm can move wafers to a location other than one which is in line with the shoulder of the arm. In contrast, the arm assembly in Fukasawa has three independent degrees of freedom and moves wafers to chambers 3a, 3b which are offset on both sides of the shoulder of the arm assembly. A person skilled in the art would not recognize that the arm in Sawada is equivalent to the arm of Fukasawa and would not substitute the Sawada arm for that in Fukasawa as stated by the Examiner.

Sawada fails to disclose or suggest that the substrate is moved along one of a number of parallel axes, much less parallel axes straddling the shoulder (of the transport arm) as otherwise called for in claim 29. Even if Fukasawa and Sawada were combined (though the appellant maintains that it would not have been

obvious for one skilled in the art to do so), the combination of Fukasawa and Sawada does not provide the features called for in claim 29. Modifying the three independent degree of freedom arm in Fukasawa in view of the two independent degree of freedom arm in Sawada which can move substrates only along a centerline axis through the shoulder of the arm will not provide rotation of the arm, radial displacement of the wrist and rotation of the end effector about the wrist, all in concert so the substrate is moved along one of a number of parallel axes straddling the shoulder as called for in claim 29.

Claim 29 is not obvious over Fukasawa in view of Sawada. The Examiner's rejection of claim 29 based on Fukasawa in view of Sawada should be reversed.

5. Claims 8-16

a. Claim 8 is not obvious over Bacchi in view of Ohta.

Claim 8 recites that the transport arm transports substrates into and out of three side by side substrate holding areas with the drive section in only one location relative to the three holding areas and the three side by side holding areas being generally aligned with each other along one side of the drive section.

Neither Bacchi nor Ohta disclose or suggest the features recited in claim 8. In Fig. 6A, Bacchi discloses move profiles of hand 30 for retrieving wafers from two cassettes 168l, 168r. Nowhere does Bacchi make any mention of the transport arm transporting substrates to three side by side holding areas. In Fig. 1, Ohta discloses shelve stations 20, and a loading/unloading station 21 which are arranged in a circular array (col. 2, lines 45-46).

A pallet loading/unloading device 30 is provided in the center of the circular array of shelves 20. Thus, the shelve stations 20 in Ohta are disposed in an arc around the loading/unloading device 30. Correspondingly, the sides of the shelve stations 20 extend radially outwards, as seen in Fig. 1, diverging away from each other. Hence, none of the shelve stations 20 are located side by side to each other. In addition, the arcuate dispositions of the shelve stations 20 also means that by definition the shelve stations are not aligned with each other on one side of the drive section. Ohta fails to disclose three side by side substrate holding areas which are aligned with each other on one side of the drive section as called for in claim 8. The disclosure in Ohta (of shelves 20 placed in an arc around the loading/unloading device 30) would not make it obvious to one skilled in the art to modify the transport apparatus in Bacchi (having only two cassettes on side of the drive section) in order to provide three side by side substrate holding areas aligned with each other along one side of the drive section to which the transport arm transports substrates with the drive section in only one position.

Claim 8 is not obvious over Bacchi in view of Ohta. The Examiner's rejection of claim 8 based on Bacchi in view of Ohta should be reversed.

6. Claim 8 is not obvious over Ohta in view of Bacchi.

As noted above, neither Ohta nor Bacchi disclose the features recited in claim 8. Ohta discloses four shelves 20 and one loading/unloading station 21 arranged in a circle around the load/unload device 30. Bacchi discloses that the arm mechanism 10 transports substrates to two cassettes 168l, 168r located on one side of the drive section (see Fig. 6A). Thus, modifying Ohta in

view of Bacchi would at best result in the Ohta apparatus having two adjoining shelves 20 which are located side by side on one side of the drive section as in Bacchi. This, however, is different than the features called for in claim 8, which calls for three side by side substrate holding areas aligned in with each other on one side of the drive section.

Claim 8 is not obvious over Ohta in view of Bacchi. The Examiner's rejection of claim 8 based on Ohta in view of Bacchi should be reversed.

6. Claim 28

a. Claim 28 is not obvious over Bacchi in view Ohta.

Claim 28 recites that the transport arm transports substrates along generally parallel axes of translation straddling the drive section towards and away from two side by side substrate holding areas along a side of the processing apparatus. Nowhere is this disclosed or suggested in Bacchi, or Ohta. Fig. 6A, in Bacchi shows one axis of translation (the left axis to cassette 168l) extends through the shoulder pivot of the arm. Thus, as can be seen in Fig. 6A, the axes of translation in Bacchi clearly do not straddle the drive section of the arm as called for in claim 28. The shelves 20 in Ohta are in an arc with the drive section in the center, and hence, the axes of translation are by definition converging/diverging, and clearly not parallel as called for in claim 28. Also, with the shelves 20 disposed in a circle, and the load/unload mechanism at the center of the circle, axes of translation in Ohta extend through the mechanism, and do not straddle the mechanism.

Claim 28 is not obvious over Bacchi in view of Ohta. The Examiner's rejection of claim 28 based on Bacchi in view of Ohta should be reversed.

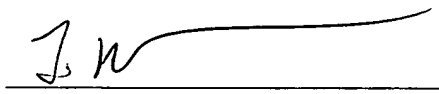
b. Claim 28 is not obvious over Ohta in view of Bacchi.

As noted before, in Ohta the axes of translation are not parallel and do not straddle the drive section of the transport mechanism. Bacchi also fails to disclose or suggest parallel axes of translation that straddle the drive section of the transport arm. Thus, combining Ohta and Bacchi cannot provide a transport arm that transports substrates along parallel axes of translation straddling towards and away from two side by side substrate holding areas along a side of the processing apparatus as called for in claim 28. Claim 28 is not obvious over Ohta in view of Bacchi. The Examiner's rejection of claim 28 based on Ohta in view of Bacchi should be reversed.

IX. Conclusion

In view of the arguments presented above, it is respectfully requested that the Examiner's rejections of Claims 1-5, 8-16, 26, and 28-29 be reversed.

Respectfully submitted,



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APPENDIX

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REJECTED CLAIMS

1. A method for transporting a substrate into and out of a substrate holding area on a substrate processing apparatus comprising the steps of:

providing the substrate processing apparatus with a transport arm connected to a drive section with two drive shafts;

providing the substrate on an end effector of the transport arm, the end effector being rotatably mounted to a wrist of the transport arm; and

rotating the two drive shafts to effect rotation of the transport arm about an axis of rotation at a shoulder of the transport arm for rotating the wrist about the axis of rotation, and

to effect extension of the transport arm for radially displacing the wrist of the transport arm relative to the axis of rotation at the shoulder of the transport arm, wherein the extension of the transport arm to radially displace the wrist causes rotation of the end effector about the wrist to rotate the substrate about the axis of rotation at the shoulder of the transport arm in concert with rotation of the wrist about the axis of rotation at the shoulder of the transport arm so that the substrate is moved along one of a number of generally parallel axes of translation straddling the drive section.

2. A method as in Claim 1, wherein the steps of moving and rotating are harmonized with each other so that the substrate on the end effector is substantially rectilinearly translated with respect to the substrate holding area along an axis of translation extending through a substrate transport passage of the substrate holding area.

3. A method as in Claim 1, wherein the substrate processing apparatus comprises at least two of the substrate holding areas located side by side to each other, the transport arm transporting substrates into and out of each of the two substrate holding areas, and wherein the axis of rotation at the shoulder of the transport arm stays in one location relative to the two substrate holding areas when the transport arm transports substrates into and out of each of the two substrate holding areas.

4. A method as in Claim 1, wherein the transport arm is an articulated arm comprising an upper arm link and a lower arm link and wherein the step of moving comprises independently rotating the lower arm link relative to the upper arm link.

5. A method for transporting a substrate into and out of a substrate holding area comprising the steps of:

providing the substrate on an end effector of a transport arm;

rotating the transport arm as a unit about an axis of rotation; and

moving the end effector of the transport arm to radially displace the end effector relative to the axis of rotation, the end effector being moved from an initial position to a final position, the initial and final positions of the end effector being connected by an axis of translation of the end effector;

wherein the radial displacement of the end effector complements the rotation of the transport arm about the axis of rotation to result in the substrate being substantially rectilinearly translated along the axis of translation to and from the substrate holding area, the axis of translation being one of two generally parallel axes of translation on opposite sides of the drive section.

8. A substrate transport apparatus comprising:

a drive section; and

a robot transport arm mounted to the drive section, the robot transport arm having a wrist and an end effector to hold a substrate thereon, the end effector being rotatably mounted to the wrist to rotate about the wrist, rotation of the end effector about the wrist being slaved to the robot transport arm;

wherein the robot transport arm is adapted to transport substrates into and out of three general side by side orientated substrate holding areas with the drive section being located in only one location relative to the three holding areas, and wherein the three side by

side substrate holding areas are generally aligned with each other and disposed along one side of the drive section.

9. A substrate transport apparatus as in Claim 8, wherein the end effector is slaved to the robot transport arm so that, when the end effector rotates about the wrist relative to the robot transport arm, the substrate on the end effector and the wrist rotate about the drive section at a substantially equal rate.

10. A substrate transport apparatus as in Claim 8, wherein the robot transport arm is mounted to a drive shaft of the drive section, and wherein the end effector is slaved to the robot transport arm so that when the robot transport arm radially translates the end effector relative to the drive shaft the end effector is automatically rotated about the wrist.

11. A substrate transport apparatus as in Claim 10, wherein the end effector rotates about the wrist to rotate the substrate about the wrist so that as the substrate rotates about the wrist, the substrate, the wrist and the drive shaft remain generally aligned.

12. A substrate transport apparatus as in Claim 8, wherein the robot transport arm is an articulated arm comprising an upper arm link and a lower arm link, the upper arm link extending from a shoulder of the robot transport to an elbow of the robot transport arm and the lower arm link extending from the elbow to the wrist of the robot transport arm, and wherein the robot transport arm is mounted at the shoulder to a drive shaft of the drive section.

13. A substrate transport apparatus as in Claim 12, wherein the upper arm link is mounted to the drive shaft to rotate in unison with the drive shaft, and wherein the lower arm link is rotatably mounted to the upper arm link to rotate relative to the upper arm link.

14. A substrate transport apparatus as in Claim 12, wherein the robot transport arm includes means for automatically rotating the end effector about the wrist, and wherein the means for automatically rotating the end effector drivingly connect the lower arm link to the end effector slaving rotation of the end effector about the wrist to the rotation of the lower arm link about the elbow.

15. A substrate transport apparatus as in Claim 12, wherein the upper arm link and the lower arm link are rotated independently of each other to effect robot transport arm transport of substrates into and out of the three substrate holding areas.

16. A substrate transport apparatus as in Claim 8, wherein the robot transport arm transports substrates substantially rectilinearly into and out of each of the three substrate holding areas along axes of translation corresponding to each holding area.

26. A method as in Claim 1, wherein the substrate processing apparatus comprises at least three of the substrate holding areas located side by side to each other, the transport arm transporting substrates into and out of each of the three substrate holding areas, and wherein the axis of rotation at the shoulder of the transport arm stays in one location relative to

the three substrate holding areas when the transport arm transports substrates into and out of each of the three substrate holding areas.

28. A substrate transport apparatus comprising:

a drive section with a first drive shaft, and a second drive shaft;

a robot transport arm mounted to the drive section, the robot transport arm including an upper arm, a forearm pivotably connected to the upper arm to pivot about an elbow of the upper arm, and an end effector pivotably connected to the forearm to pivot about a wrist of the forearm, the upper arm being connected to the first drive shaft so that the upper arm is rotated about the drive section when the first drive shaft is rotated, the elbow being connected to the second drive shaft so that the forearm is rotated about the elbow when the second drive shaft is rotated, the end effector being slaved to the forearm so that when the forearm rotates about the elbow the end effector rotates about the wrist;

wherein the robot transport arm is adapted to transport substrates with the end effector along generally parallel axes of translation straddling the drive section to and from two side by side substrate holding areas disposed along a side of a substrate processing apparatus with the drive section being located in only one location relative to the substrate processing apparatus.

29. (Amended) A method for transporting a substrate into and out of a substrate holding area on a substrate processing apparatus comprising the steps of:

providing the substrate processing apparatus with a transport arm connected to a drive section having two drive shafts;

providing the substrate on an end effector of the transport arm, the end effector being rotatably mounted to a wrist of the transport arm; and

rotating the two drive shafts to effect rotation of the transport arm about an axis of rotation at a shoulder of the transport arm for rotating the wrist about the axis of rotation, and

to effect extension of the transport arm to radially displace the wrist of the transport arm relative to the axis of rotation at the shoulder of the transport arm, wherein the extension of the transport arm when the second drive shaft is rotated effects rotation of the end effector about the wrist, the rotation of the transport arm about the axis of rotation at the shoulder, the extension of the transport arm to radially displace the wrist relative to the axis of rotation at the shoulder and the rotation of the end effector about the wrist being in concert so that the substrate is moved into and out of the substrate holding area along an axis of translation from a number of generally

parallel axes of translation straddling the axis of rotation at the shoulder.